

In The Claims

Please amend the claims, as indicated below. The current status of each claim is shown in the complete list of claims 1-21 below.

1.-3. (canceled)

4. (Currently amended) Apparatus for use in the removal of at least two [one] components including a less strongly adsorbed component and a more strongly adsorbed component from a gas mixture by a TEPSA swing adsorption process having an adsorbent regeneration phase, said apparatus comprising:

an adsorber vessel comprising an inlet for said gas mixture and an outlet for purified gas separated by a flow path including a flow chamber containing a body of adsorbent, and having an inlet for regeneration gas and an outlet for regeneration gas separated by a flow path including said flow chamber, said inlet for said gas mixture and said outlet for purified gas optionally constituting also said outlet for regeneration gas and said inlet for regeneration gas, said inlet for regeneration gas, said inlet for regeneration gas having an inlet nozzle containing at least one heater element, wherein said body of adsorbent has a first end which is adjacent said inlet for regeneration gas and a second end which is remote from said inlet for regeneration gas, and the at least one [or each] heater element is located so as not to penetrate through the first end of the body of adsorbent,

a source of gas mixture to be separated connected to the inlet for gas mixture,

a source of regeneration gas connected to the inlet for regeneration gas, and control means for operating a TEPSA cycle of adsorption and regeneration in which:

gas mixture is passed over the adsorbent in a first flow direction and is purified by the adsorption of at least two [one] components and flow of the gas mixture over the adsorbent is stopped,

regeneration gas is passed over the adsorbent in [the same or in] an opposite flow direction, the regeneration gas being heated by the at least one [said] heater element so as to desorb the less strongly adsorbed component, [and]

heating of said regeneration gas is terminated and regeneration gas at a lower pressure than a pressure during the adsorption phase is continued to be passed over the adsorbent so as to desorb the more strongly adsorbed component.

and

flow of the regeneration gas is stopped and flow of the gas mixture is resumed.

5. (Currently amended) Apparatus as claimed in Claim 4, comprising two or more [said] adsorption vessels arranged in parallel for operation such that at least one [said] vessel is online for adsorption whilst at least one other [said] vessel is being regenerated.

6. (Cancelled)

7. (Currently amended) A TEPSA swing adsorption method of removing at least two [one] components including a less strongly adsorbed component and a more strongly adsorbed component from a gas mixture, said method comprising:

in an adsorption phase, passing said gas mixture in a first direction into an adsorber vessel comprising an inlet for said gas mixture and an outlet for purified gas separated by a flow path including a flow chamber containing a body of adsorbent, and having an inlet for regeneration gas and an outlet for regeneration gas separated by a flow path including said flow chamber, said inlet for said gas mixture and said outlet for purified gas optionally constituting also said outlet for regeneration gas and said inlet for regeneration gas, said inlet for regeneration gas having an inlet nozzle containing at least one heater element, wherein said body of adsorbent has a first end which is adjacent said inlet for regeneration gas and a second end which is remote from said inlet for regeneration gas, and the at least one [or each] heater element is located so as not to penetrate through said first end of the body of adsorbent, so that said gas mixture is purified by the adsorption of at least two one] components and after a period stopping the flow of the gas mixture into the vessel, and

in a regeneration phase, passing regeneration gas into the vessel through the inlet for regeneration gas in [the same or in] an opposite flow direction whilst heating said regeneration gas by the at least one [said] heater element for a period so as to desorb the less strongly adsorbed component, terminating heating of said regeneration gas and continuing to pass regeneration gas at a lower pressure than pressure during the adsorption phase so as to desorb the more strongly adsorbed component, stopping said flow of the regeneration gas and resuming said flow of the gas mixture.

8. (Previously presented) A method as claimed in Claim 7, wherein said heating is continued in the regeneration phase for a period not exceeding 90 minutes.
9. (Previously presented) A method as claimed in Claim 8, wherein the heating is continued in the regeneration phase for a period not exceeding 60 minutes.
10. (Previously presented) A method as claimed in Claim 8, wherein said heating is continued for a period not exceeding 30 minutes.
11. (Currently amended) A method as claimed in Claim 7, wherein the distance between the at least one heater element [or elements] and the adsorbent is such that the transmit time between the most downstream point of the heater element or elements and the adsorbent is no more than 4 minutes.
12. (Previously presented) A method as claimed in Claim 7, wherein upon initiating a constant rate of heating of the regeneration gas, the regeneration gas immediately upstream of the adsorbent reaches an essentially steady state temperature within no more than 1 minute.
13. (Previously presented) A method as claimed in Claim 7, wherein the gas is air and the components removed by adsorption comprise water and carbon dioxide.
14. (Previously presented) A method of air separation by cryogenic distillation to produce an oxygen rich gas and a nitrogen rich gas, comprising a pre-purification of the air to remove at least carbon dioxide and water which is conducted by a swing adsorption method as claimed in Claim 7.